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A SIMPLE MODEL FOR PILE-UP DURING INDENTATION BY A RIGID
CONE

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Recent experimental and analytical studies have shown that the indentation pile-up which occurs primarily in soft metals with little or no tendency to work harden can significantly affect the accuracy with which mechanical properties can be measured by load and depth sensing indentation methods (nanoindentation). Pile-up affects the contact depth and the contact area in a manner which is not accounted for in data analysis procedures. A simple model is presented which can be used to predict the amount of pile-up in elastic-perfectly-plastic materials indented by a rigid cone. The model essentially provides a means for interpolating between two limiting behaviors with well-known solutions: purely elastic and rigid-plastic contact. The model compares favorably with finite element simulations and can also be used to directly relate the indentation load-displacement data to the yield stress and elastic modulus. The utility and limitations of the model are discussed.

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